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SPECIES IDENTIFICATION IN THE EASTERN *CREMATOGASTER* (HYMENOPTERA: FORMICIDAE)

Clifford Johnson
Department of Zoology
University of Florida
Gainesville, FL 32611
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ABSTRACT

New data and reviews of previous taxonomic treatments of eastern *Crematogaster* species confirm the synonymy of *C. clara*, in the Buren sense, with *C. pilosa* Emery, and *C. punctulata* Emery with *C. lineolata* (Say). Six eastern species are now recognized, *C. ashmeadi* Mayr, *C. atkinsoni* Wheeler, *C. cerasi* (Fitch), *C. lineolata*, *C. pilosa* and *C. vermiculata* Emery. Diagnostic characters, geographic distributions and habitats are discussed for each species, including an illustrated key to workers.

Key Words: *Crematogaster* species, key.

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INTRODUCTION

Six species of the genus *Crematogaster*, subgenus *Crematogaster*, occur in the eastern U. S. constituting a conspicuous part of the ant fauna. Species of this genus have considerable ecological interest and entomologists studying such interactions require reliable identifications. The following text and key have that objective. All six species occur only in the southeastern states and the new data originate from that region. However, the species key is applicable to the United States east of the Mississippi River.

The taxonomy of *Crematogaster* was treated 38 years ago by Creighton (1950) in the "Ants of North America" and the subgenus was specifically reviewed 18 years later by Buren (1968). In that interval, no new species were recognized in the East and the need for further work may be questioned. However, the works of both above authors include inaccuracies and non - illustrated keys. In the more recent study (Buren, 1968), a variant of *C. lineolata* (Say) was given full species status and another species was identified as a synonym of a form not occuring in the East. Buren gave no explanation for his nomenclatural usage. To avoid that omission in the present paper, a brief taxonomic history for each species precedes the recent data. This information is particularly important for the two reinterpretations noted above.

Well over 95 percent of all specimens coming to entomologists' attention are workers and identification focuses on that caste. Workers of the genus may be recognized by the following characters. The pedicel connecting the alitrunk and gaster consists of two segments, a petiole and post - petiole, and the latter attaches to the gaster's dorsal surface. The gaster is distinctly more convex ventrally than dorsally. The antennae have 11 segments and the frontal carina, just median to each antenna, expands laterally to slightly overlap the antennal insertion. The subgenus is distinguished by a distinct, longitudinal groove along the mid - dorsal surface of the post - petiole.

MATERIALS AND METHODS

The author's material includes (1) specimens collected without nest association and (2) workers from specific colonies, the nest series. Members of a nest series consist of specimens taken from a recently opened nest while the ants were, in large part, moving the brood to safety. The specifics and localities of nest series are given in context with their discussion. The nest series provide an unambiguous measure of intraspecific variation, particularly important for *C. lineolata* and *C. pilosa* Emery. In addition, specimens have been studied from the U. S. National Museum and the George C. and J. Wheeler Collections.

The descriptions of diagnostic attributes avoid terminology often used only with Formicidae. All terms are defined in Torre - Bueno (1962) or most standard insect references. The term alitrunk refers to thorax and fused propodeum or epinotum; however, the thorax is retained in identifying sculpture and pilosity of the pro - and mesothoracic segments. The propodeal spines are equivalent to epinotal spines in most references. Interpretation of sculpture and pilosity on specimens in alcohol is generally unsuitable for careful study. Reliable identification of these ants requires specimens mounted on points, good illumination and magnification. A binocular scope with 10× eye pieces and 12×, 25× and 50× objectives is ideal.

Characters employed for identification of workers in North American *Crematogaster* species are largely thoracic sculpture, pilosity and propodeal spines. To enhance their use in the following key, these attributes and the major variants are described with appropriate figures. Propodeal spines have been classified as short and long using a ratio of length to distance between bases of the two spines across the propodeum. Spine length is the straight line distance from apices to base, namely the medial point where the spine shaft converges with the body, and distance between bases is the transverse dimension between that point of the two spines. The ratio, spine length/distance between bases, is SL/DB. Width and length measurements of various structures or ratios from such figures have diagnostic value with some ants; however, these methods have not yielded useful results. The values overlap extensively between species due to the range in body size within most colonies. Color rarely has taxonomic value but correlates somewhat with geographic distribution. A bicolored pattern in the following text consists of a light tan, yellowish - brown or reddish - brown head and thorax with a dark, near - black gaster.

For each species, its taxonomic history and problems of variability, if applicable, precede a description of distinguishing characters and geographic distribution. The species key follows these accounts. To expedite comparisons of specimens with illustrations, the species are identified by the same letter in all figures. The hairs have been drawn in the figures slightly thicker than true proportions, as hair - thin lines may become obscure upon reduction. This precaution does not compromise use of the key.

SPECIES ACCOUNTS

Crematogaster ashmeadi Mayr

Taxonomy and Variability: This species was described by G. Mayr in 1886 with a type locality of "Florida" and has survived without taxonomic change to the

present. Wheeler (1932) did recognize a variant, *C. ashmeadi* var *matura*, based largely on a darker body color and slightly more robust size. Creighton's (1950) placement of this taxon in synonymy with *C. ashmeadi* was never questioned. Ants with attributes described for Wheeler's *matura* may be found in most large colonies of *C. ashmeadi* and show no correlation with habitat variability. Two other color morphs exist that have a nonrandom distribution and an undescribed species was suggested on this basis by Deyrup and Trager (1986). In one color form, the body is dark black throughout and in the other form, a bicolored body exists involving a light yellowish - tan or reddish - brown head and thorax with a black gaster. No structural differences between these types are known.

The black - bodied morph is typically found on hardwood trees while the bicolored form is found on pine trees, essentially all species of pine in the ant's range. Both forms occur, with this general preference for tree - type, throughout Florida to northern Georgia and into South Carolina and Alabama, probably throughout the species range where both tree types occur. In hardwood forests, only the black - bodied morph exists; in pine - dominated flatwoods, only the bicolored form is found. However, where both hardwoods and pines are closely intermixed, both color types occur togther in columns of foraging specimens and the color difference is lost in some specimens. Callow specimens of the black - bodied form are bicolored until the cuticle has hardened and judging a nest series is somewhat subjective; however, both types, in mixed forests, have been found together in single colonies. Some components in the food chains of pine and hardwood trees may influence the ants' color: however, no precedent for such variation is known. These observations do not dismiss the possibility of an unrecognized species.

Attributes: The head, thorax and gaster have appressed pubescence; however, occasional specimens have some suberect pubescence on both head and dorsum of thorax. One to three long, erect hairs exist on each humeral shoulder of the pronotum, Fig. 2 D; occasional specimens lack these hairs on at least one shoulder. Erect hairs very uncommon on dorsum of first gastric segment. Propodeal spines short, SL/DB < 1.0, with a stocky base due to convex outer margins; inner margins in dorsal view approximately parallel to longitudinal body axis directing apices straight to the rear, Fig. 4 D. Black and bicolored specimens exist with an association to tree type as discussed above.

This species is common throughout the Piedmont and Coastal Plain of the southeastern states from Virginia to the Florida Keys, westward to Texas and has been reported in the Bahamas. The ants nest in pine, hardwoods, woody shrubs and vines of both mesic and xeric habitats.

Crematogaster atkinsoni Wheeler

Taxonomy and Variability: Wheeler (1919) described *C. atkinsoni*, the last eastern *Crematogaster* species to be recognized, from a type locality of Ft. Myers, Florida, and the name has retained full species status to the present time. In 1887, Atkinson described a carton type nest of a *Crematogaster* species determined for him as *C. lineolata*, and Wheeler later recognized Atkinson's report as an early reference to the new species.

The value of appressed and suberect pilosity in distinguishing *C. atkinsoni* from congeneric species was not used diagnostically prior to Buren (1968), and *C. atkinsoni* specimens were likely misdetermined in faunal studies. In fact,

Creighton's (1950) key does not correctly identify *C. atkinsoni*. Creighton describes the species as "...with at least 15 erect hairs which are scattered over the entire promesonotum", a condition quite unlike *C. atkinsoni*. The record of *C. atkinsoni* for Oklahoma, surely a misdetermination, probably developed in this way (Young and Howell, 1964).

The color of *C. atkinsoni* is typically dark brownish - grey to black and occasional specimens are bicolored with a brown thorax and black gaster, or pale yellowish brown over the whole body. Wheeler (1919) recognized a color variant, *C. atkinsoni* var *helveola*, reflecting this variation; however, it occurs widely intermixed in the colonies of dark - bodied specimens. Creighton (1950) correctly synonymized it with *C. atkinsoni*. The species typically occurs only about salt and freshwater marshes along the southern Coastal Plain and a distinct color variant having a rosy - red color over the whole body occurs in scattered localities along the salt marshes bordering the North Florida Gulf Coast. These ants are very distinct in color and the propodeal spines are slightly thicker in some specimens but no other morphological characters separate the two forms. The red variant constructs carton nests in and about the marsh, often above standing water, high enough to escape the tides. Other nests may occur within grass stems on dry land bordering the marsh, but even in these nests a carton component occurs at the base of the grass stems. Within the same marshes, the dark - colored, typical *C. atkinsoni* morph occurs nesting in a variety of circumstances but using a wide array of nest sites often with no carton involved. Even without distinct morphological differences, justification for recognizing the red variant as a distinct species could be given if the following observations could be resolved.

From a marsh just east of Cedar Key, Levy County, Florida, five nest series were taken, two of the typical dark - bodied morph containing 31 and 38 specimens and three of the red variant containing 40, 32, and 43 specimens. Individual ants in both colonies of the typical morph were all consistently dark - bodied. In two colonies of the red variant, 2 of 40 and 3 of 32 specimens were dark - bodied. These dark - bodied specimens were carrying brood along with the red - bodied ants and were behaving as typical members of the colony. The third nest series of 43 specimens contained only red - bodied ants. Genetic polymorphism for color in ants is uncommon but this case requires more study before taxonomic intervention.

Attributes: Pubescence on the head, thorax and gaster is fine and closely appressed. On the head, the pubescence is closely spaced and appears to lie in orderly rows, Fig. 6 E. One or two (rarely three) long erect hairs on each humeral shoulder of the pronotum, Fig. 2 E, occasional specimens have 2 to 3 short erect hairs intermixed with appressed pubescence on the dorsum of the gaster's first segment. Propodeal spines long, SL/DB > 1.0; outer and inner margins, in dorsal view, are approximately straight and apices distinctly diverge from longitudinal body axis, Fig. 5 E. Typical specimens are greyish - black or bicolored and a red morph exists as discussed above.

This species occurs in and about both fresh and salt water marshes or similar habitats of the Coastal Plain from North Carolina through Florida to the Keys including inland sites and west along the coast to at least Alabama. The ant nests in a variety of both arboreal situations or fallen logs on the ground near water, often building conspicuous carton nests. *Crematogaster atkinsoni* and *C. pilosa* may occur together in the same habitat and require care in identification.

Crematogaster cerasi (Fitch)

Taxonomy: Buren's (1958, 1968) resurrection of *C. cerasi* to full species has support of all relevant data. The history of *C. cerasi* prior to Buren's work is not extensive. Fitch (1854) described the species as *Myrmica cerasi*. According to Enzmann (1946), a type was not designated but Fitch's material most likely came from New York state, and Wheeler's (1917) review of Fitch's work gave no further information for *C. cerasi*. Pergande, of the U. S. National Museum, sent specimens he determined as *C. cerasi* to Emery in Europe and those specimens form our present concept of the species. Emery (1895) revised the name to *C. lineolata* var *cerasi* and retained this treatment 27 years later (Emery, 1922). American workers made little use of the name. Creighton (1950) finally synonymized *C. cerasi* with *C. lineolata*; however, his key directs the reader to a *C. lineolata* form having up to 15 erect hairs scattered over the dorsum of the promesonotum and to a second *C. lineolata* form having erect hairs confined to the humeral angles plus a few hairs occasionally seen in the mesoepinotal suture. This dichotomy depicts *C. lineolata* and *C. cerasi*, respectively, in the Buren sense. Buren (1968) distinguished *C. cerasi*, from *C. lineolata* as having erect hairs confined to each shoulder of the pronotum.

Buren's (1968) distribution for *C. cerasi* suggested a limited occurrence in the South, namely "...reaching Georgia through the Appalachians, Arkansas in the Ozarks." The faunal studies prior to 1958 for the Southeast never mentioned the species; however, its distribution in the South is more extensive. Van Pelt and Gentry (1985) found *C. cerasi* in lower elevations in South Carolina and recent collections have found the species in north - central Georgia and both north and south Florida. I have only one nest series taken in Stone Mountain State Park in Murray County of northern Georgia. Forty - eight specimens are available from this colony and all individuals have the *C. cerasi* characters. In both Georgia and Florida, I have never taken both *C. lineolata* and *C. cerasi* togther in the same area, giving further support to the contention that the two forms are distinct.

Attributes: Fine longitudinal ridges or striations on thoracic dorsum usually short and discontinuous, the intervening cuticle rough, granulate. Some specimens have well - expressed striations with smooth intervening cuticle; others have reduced striations and conspicuously granulose cuticle. Pubescence of head, thorax and gaster appressed; one to three long erect hairs on each humeral shoulder of pronotum, Fig. 2 A. Rarely 1 to 3 short erect hairs about the anterior margin of the propodeum and a like number occasionally intermixed with appressed pubescence of first segment of gaster. Propodeal spines long, SL/DB > 1.0, and spines typically diverge posteriorly relative to longitudinal body axis, Fig. 3 A. Some specimens show less divergence of the spines and have evenly tapered spines rather than undulating margins. These ants are largely bicolored; however, some entirely blackish specimens appear in the Florida collections.

This species occurs in Quebec, Canada, and most of the northcentral and northeastern U. S. It is an uncommon species in the South; however, records exist for North Carolina, Georgia, South Carolina and Florida southward to Polk, Hernando and Dade Counties. In Florida, specimens have been taken only in xeric upland habitats while northward, collections exist from mesic woodlands and margins of cultivated fields. Nests are generally in or under fallen logs or stumps, not in arboreal conditions.

Crematogaster lineolata (Say)

Taxonomy and Variability: Every *Crematogaster* species in eastern North America excepting *C. ashmeadi, C. atkinsoni* and *C. vermiculata* Emery was treated as *C. lineolata* at some point in taxonomic history; even *C. atkinsoni* was initially misdetermined as *C. lineolata* (Atkinson, 1887; Wheeler, 1919). In addition, several subspecies and varieties of *C. lineolata* were named and Buren's (1958, 1968) revision recognized two of these infraspecific taxa, *punctulata* and *cerasi*, as full species.

Distinction between *punctulata* and *lineolata* - like ants has long been problematical, as reflected in taxonomic history. *Crematogaster lineolata* was originally described by Say (1836) as *Myrmica lineolata* from Indiana and the types, if ever designated, are lost. Emery (1895) then described *C. punctulata* with a type locality in Colorado. In the following years, Wheeler (1908, 1919) and Emery (1922) revised the name, *punctulata*, three times using *C. lineolata opaca* var. *punctulata*, *C. opaca* var. *depilis* var. *punctulata* and *C. lineolata* var. *punctulata*. The intergrade - like phenotype of *punctulata* with other taxa produced the taxonomic uncertainty. Even the original author, Emery, reversed his view of full species status. Creighton (1950) removed most trinomials but left *C. lineolata punctulata* intact commenting, however, on the "intergrades" with the typical *C. lineolata*. Later, Buren (1958) indicated *punctulata* - like ants were a distinct species but gave no explanation of earlier indecision and, in 1968, he incorporated *C. punctulata* in his key as a full species, still without explanation. Buren stated that both *C. lineolata* and *C. punctulata* have numerous erect hairs evenly covering the entire thoracic dorsum; in *C. punctulata*, the erect hairs are about equal in length on all parts of the thorax and the thoracic dorsum is punctate; in *C. lineolata*, the erect hairs are very short on the mesonotum and the thoracic dorsum is striate or rugose. The southern range of *C. lineolata* was "...south through all of the eastern states to the southern tier....". The range of *C. punctulata*, largely in the Great Plains and westward, was also "...well distributed through the southeastern states.....".

I have collected *C. lineolata*, the *punctulata* morph, and intergrades between the two forms in Franklin, Monroe, Morgan and Polk Counties of Georgia, Dorchester and Saluda Counties of South Carolina, and Chilton County of Alabama. Specimens of *C. lineolata*, together with intermediate phenotypes between that form and the *punctulata* morph, have also been taken in Gilchrist, Leon and Nassau Counties of north Florida but no distinct *punctulata* are available for that state. Up to thirty percent of the ants taken by general collecting in central Georgia, South Carolina and Alabama could not be satisfactorily identified to either species. Some specimes possessed *C. punctulata* - like sculpture and *C. lineolata* - like pilosity, other specimens expressed the reverse combination of characters. Still others possessed intermediate sculpture consisting of short but distinct striation separated by pitted cuticle and intermediate pilosity relative to hair length. Approximately 5 to 10 percent of the Florida specimens deviated form the *C. lineolata* condition.

Four nests were located in Georgia, two in High Falls State Park, Monroe county, and two in Hard Labor State Park, Morgan county. The two colonies in Monroe County are represented by 42 and 71 ants per nest while the two colonies from Morgan County are represented by 38 and 62 specimens per nest. Using Buren's characters and reporting the colonies in the above order, 27, 45, 24, and 40 ants, respectively, possessed clear *C. lineolata* characters, 5, 6, 4 and 6 ants,

respectively, exhibited *C. punctulata* characters and 10, 20, 10 and 16 ants, respectively, were intermediate in either or both sculpture and pilosity. These four colonies lead to the conclusion that 63.1 to 64.5 percent of the ants per nest are *C.. lineolata*, 8.4 to 11.9 percent are *C. punctulata*, and 23.8 to 28.2 percent of the specimens per nest could not be determined to either taxon. The frequency of intermediate specimens in the nests was quite close to the frequency of such ants noted above foraging without nest association. D. R. Smith kindly provided specimens on loan from the U. S. National Museum determined as *C. punctulata* and *C. lineolata* including both Southeast and Midwest localities. The specimens of both taxons were comparable in all respects to ants taken from each of the above nest series. Specimens in the Wheeler collection lead to the same conclusion. Creighton's (1950) key gives two pathways to *C. lineolata*. As explained above, one path leads to the form now interpreted as *C. cerasi*. The other path leads to *C. lineolata punctulata*. Thus Creighton also used the latter name synonymously with the present interpretation of *C. lineolata*. While the literature carries many references to *C. lineolata*, no study considers the infraspecific morphological variation existing in a single colony. The nest series data given above and taxonomic history both identify a single variable species, polymorphic for both sculpture and pilosity. In the East, that species can only be named *C. lineolata*. The *punctulata* morph is more widespread and abundant in the West. A species distinct from *C. lineolata* may occur in that region; however, field studies in the area are necessary to resolve the question. Another variant, *C. lineolata subopaca*, was described by Emery in 1895 with a type locality in Virginia. This name has appeared in faunal lists of the South, and Creighton retained it as an eastern variant since he interpreted *punctulata* as a western form. Buren failed to mention this taxon, Smith (1979) included it in the synonymy of *C. punctulata* in the hymenopteran catalog, and it is interpreted here as a synonym of *C. lineolata*.

Attributes: Low, longitudinal ridges or striations on thoracic dorsum with some ridges continuous across pro - and mesonotum, others shorter and occasionally striations anastomose into a reticulate pattern. Cuticle between ridges punctate or granulose. Some specimens have ridges reduced to small swellings on anterior of pronotum and dorsum appears conspicuously punctate. Pubescence of head and gaster appressed and typically sparse on thoracic dorsum. Larger, erect hairs numerous on thoracic dorsum, a band of such hairs occurs transversely across pronotum, Fig. 2 B, other erect hairs more scattered over mesonotum. Scattered, erect hairs typically intermixed with appressed pubescence on dorsum of gaster's first segment. Propodeal spines long, SL/DB > 1.0, slender and tapering evenly to apices. Inner and outer margins in dorsal view approximately straight and spines typically diverge posteriorly, Fig. 3 B. In some specimens, the spines show less divergence from the longitudinal body axis. Specimens north of Florida are usually bicolored while the Florida specimens are often blackish over the entire body.

This species occurs in Quebec, Canada, through most of the northcentral and northeastern U. S. and southward to Putnam County in north Florida. It is an uncommon ant in the South. Mesic forests, overgrown grassy fields and a variety of disturbed or landscaped habitats are utilized in the North. Southward, the ants live in xeric upland sand hills, stands of Turkey Oaks or equally dry coastal hammocks along the Atlantic Coast. Nests are in or under fallen logs on the ground but individuals will forage into trees and shrubs. The habitats of *C.*

lineolata and *C. cerasi* are similar; however, the two species have never been seen by the author in one area.

Crematogaster pilosa Emery

Taxonomy and Variability: The name, *C. clara* Mayr, after being placed in synonymy with *C. laeviuscula* Mayr, has been applied to one of the common eastern ants and the ants named in this way represent a species other than *C. laeviuscula*. Mayr (1870) described two forms as *C. laeviuscula* and *C. clara* giving the type locality of both as "Ft. Cobb, Texas". In the following years, Emery (1895, 1922) and Wheeler (1908, 1919) revised the name *clara* several times where usage varied from *C. lineolata* var *clara*, *C. lineolata* var *laeviuscula* var *clara* and *C. laeviuscula* var *clara*. The principal contribution in this era was Wheeler's recognition from the study of nest series that *C. laeviuscula* and *C. clara* were conspecific where the *laeviuscula* form was a minim of *C. clara*. Workers of young colonies are often smaller and with somewhat different morphology than observed for workers in mature, larger colonies and such a worker is an minim. Taxonomic practice of that time often recognized such morphs with a variety name and unfortunately, Wheeler did not place *clara* in synonmy with *C. laeviuscula*, the latter name having page priority. Myrmecologists compiling faunal lists up to 1950 employed all of the above names at different times.

The situation was clarified with publication of the "Ants of North America" by Creighton (1950). Creighton placed many subspecies and varieties in synonymy with appropriate names including the formal synonymy of *clara* with *C. laeviuscula* and cited additional evidence supporting that action. He gave the distribution of *C. laeviuscula* as "Oklahoma southwestward through Texas, southern New Mexico and Arizona into Mexico." Thus in Creighton's view, the name would apply to no ant in the southeastern U. S. Eight years later, Buren (1958) published Part I of what was to be a three - part revision of North American *Crematogaster*. In Part I, he states relative to *laeviuscula* Mayr and *clara* Mayr "...seems to have been the subject of the greatest confusion and numbers of errors. This once resolved, the whole classification becomes easier to understand and falls readily into good order." Unfortunately, the basis for the resolution was not mentioned. A short time later, Young and Howell (1964) again reported evidence from nest series, using Oklahoma material, showing the taxa *clara* and *laeviuscula* were conspecific.

The second part of Buren's revision appeared in 1968. The main part of that paper concerned the description of new species in the Southwest; however, he includes keys for all species. Both *C. clara* and *C. laeviuscula* were recognized as distinct. For *C. laeviuscula*, he essentially agreed with Creighton and stated "...no authentic records known east of Mississippi River." However, the range of *C. clara* was given as "...common throughout southeastern U. S. reaching Texas, Missouri, Indiana and New Jersey", and Buren made no mention of Wheeler (1908), Creighton (1950) and Young and Howell (1964), all citing evidence that the forms were conspecific. Further, he omits Oklahoma from the range of *C. clara*. Mayr (1870) gave the type locality of both forms as "Ft. Cobb, Texas", and this type locality was restated by Wheeler (1908), Emery (1922), Smith (1936) and Creighton (1950). Actually, Ft. Cobb was a military outpost to enhance peace between Indians and settlers, and was located in what is now Caddo County, Oklahoma. A town and state park of that name remain there today. The specimens were collected prior to 1870 and Oklahoma was not an official state until 1907.

Collectors in that era were often inexact with locality labels. In any event, Buren omits *C. clara* from its type locality, a point indicating that Buren and Mayr were likely using the name *clara* for different ants. Part III of Buren's revision was never published.

Recent nest series collections, a consideration of geographic variation and recognition of the studies showing conspecific status of *C. laeviuscula* and the taxon, *clara*, force a reconsideration. Twelve nest series, 32 to 108 specimens per nest of Buren's *clara* over north Florida and south Georgia, plus smaller series of additional colonies and many collections of foraging ants reveal a wide range in expression of pilosity on the head, thorax, gaster and legs. Some specimens are exactly like *C. pilosa* Emery, a species Creighton (1950) depicted as in "...Central Atlantic States, New Jersey to North Carolina." Creighton gave the distribution of *C. laeviuscula* as a southwestern form as noted above, and failed to include the Southeast in the distribution of *C. pilosa*. Thus no name was available, following Creighton (1950), for *C. pilosa* - like ants occurring over much of the Southeast. This treatment was most likely an oversight. Wheeler (1913) relegated Georgia specimens to *C. lineolata* subsp. *subpilosa* Pergande. This name was not formally published by T. Pergande, is invalid and was not used again but reflects *C. pilosa* - like ants in Georgia. Wheeler (1932) again reported *C. lineolata* subsp. *pilosa*, the name used at that date, for Florida and Smith (1933) also reported it for Florida. Buren (1968) was therefore the first author following Creighton (1950) to recognize *C. pilosa* - like ants in the Southeast and he used the name *C. clara*.

The diagnosis of *C. pilosa* appears below and involves suberect to erect pubescence, particularly on the head and gaster. D. R. Smith kindly sent the author northeastern specimens of *C. pilosa* from the U. S. N. M. for study and I can see no difference in pilosity between these specimens and many individuals one may find in colonies of Buren's *clara*. I have also studied specimens of *C. pilosa* in the Wheeler Collection and again, the specimens are replicas of many southeastern ants. Such specimens must have formed the basis of the Wheeler (1932) and Smith (1933) reports cited above. From the 12 nest series noted above, 6.0 to 9.5 percent of ants per colony possessed pilosity comparable to the common form of *C. pilosa* in the Northeast and in no nest series were ants found without part of the pubescence clearly suberect. The phenotype characteristic of southeastern specimens must also occur in the Northeast, as Buren included New Jersey in the range of his *clara*.

No reason was ever given to reject the synonymy of the taxon *clara* with *C. laeviuscula*, a result supported by three independent studies. In the latter species, non - minim specimens are characterized by appressed pubescence; therefore, the southern ants, definitely not minim specimens and having suberect to erect pubescence, must be conspecific with *C. pilosa*. In an effort to trace additional support for this interpretation, G. C. Wheeler kindly brought my attention to a letter he received from Creighton dated January 5, 1970, and stating "...Bill's *clara* (not Mayr's) is nothing but a minor variant of *pilosa* Em." Bill refers to William F. Buren. Thus, southeastern *Crematogaster* having suberect to erect pubescence are *C. pilosa* Emery. Namely, *C. clara* Mayr is synonymous with *C. laeviuscula* Mayr and *C. clara*, in the Buren usage, is synonymous with *C. pilosa* Emery.

The taxonomic history of *C. pilosa* is not complex otherwise. Emery (1895) described the ant as *C. lineolata* subsp. *pilosa* with a type locality in Washington, D. C. Wheeler (1919) considered it a full species but Emery (1922) still treated the

ant as *C. lineolata* var *pilosa*. Creighton (1950) again raised the name to full species status and all subsequent authors have followed that decision.

Attributes: Pubescence on head, thorax and legs is, in part, suberect and conspicuous on the head where hairs are rather erratically arranged appearing unkempt, Fig. 6 F. At least a few bristle - like erect hairs intermixed with appressed pubescence of gaster's first segment. Two to four long, erect hairs arise from each humeral shoulder of the pronotum, Fig. 2 F. Propodeal spines long, SL/DB > 1.0, typically slender in apical half; outer and inner margins in dorsal view sinuate with apices divergent from longitudinal body axis, Fig. 5 F. This species is especially variable. In some specimens all pubescence on the head is erect and becomes suberect to erect on legs and gaster; the longer erect hairs of the gaster's dorsum are more numerous forming a conspicuous hairy covering. Some specimens also have rather short spines with straight margins and less divergence. Specimens in Florida are often black over the entire body while northward the ants are largely bicolored.

This species is not confined to coastal marshes as thought by Buren (1968). Creighton collected it from inland Virginia (Roanoke), I have seen those specimens in the Wheeler Collection, and I have also taken the species widely in Florida and south Georgia. It is common along the Coastal Plain bordering the Atlantic Ocean and Gulf of Mexico from New Jersey to southern Florida and westward to Texas. The ant has also been reported from Indiana, Missouri and Kentucky. The species is mainly arboreal preferring mesic forests, overgrown fields, orchards, landscaped areas, and will nest in trees, grasses, reeds etc. It is rarely found on pine trees and in xeric upland habitats.

Crematogaster vermiculata Emery

Taxonomy: This species escaped collectors in the East for many years. In fact, all of the early faunal studies up to and including Creighton (1950) make no mention of an ant with *C. vermiculata* characters in the East. The confusion of this ant with other species is unlikely due to its distinct morphology given below. During this early period, T. Pergande obtained specimens and, in some inexplicable way, the locality label of Los Angeles, California, was attached. These specimens were sent to Emery in Italy, and in 1895, he described it as *C. vermiculata*. Creighton (1950) placed the name as a subspecies of *C. coarctata* giving it a western distribution but commented at length on its dissimilarity to that species.

Buren (1968: p. 112) reports a study of specimens he refers to as types of *C. vermiculata* in the U. S. N. M. Actually, no Emery types are in that institution (per. com., D. R. Smith). However, the specimens Buren studied are likely part of the series from which specimens were sent to Emery. Buren recognized the specimens as representative of a southeastern species and returned the name to full species status giving the distribution as "...arboreal species usually found only in cypress swamps; distribution possibly co - extensive with the bald cypress in southern U. S."

Attributes: A reticulate pattern of ridges on thoracic dorsum gives a wrinkled, rugose texture, the most conspicuous sculpture in eastern species. Pubescence of head, thorax and gaster appressed, typical thoracic pubescence sparse. One or two fine, erect hairs on each humeral shoulder of pronotum, Fig.2 C. Propodeal spines

short, SL/DB < 1.0; in dorsal view, outer and inner spine margins converge to direct apices straight to the rear; in lateral view, spine shape variable but apices directed obliquely upward, Fig. 4 C. As with other species, the Florida specimens are typically blackish with bicolored specimens occurring northward.

This species occurs through the Coastal Plain from North Carolina into Florida south at least into Marion County. Records are currently unavailable in northwest Florida but it has been reported from Louisiana and Arkansas. The ant is not confined to cypress trees but will utilize various hardwoods and shrubs close to standing water. I have several sizable nest series and all individuals of each colony express the *C. vermiculata* characters.

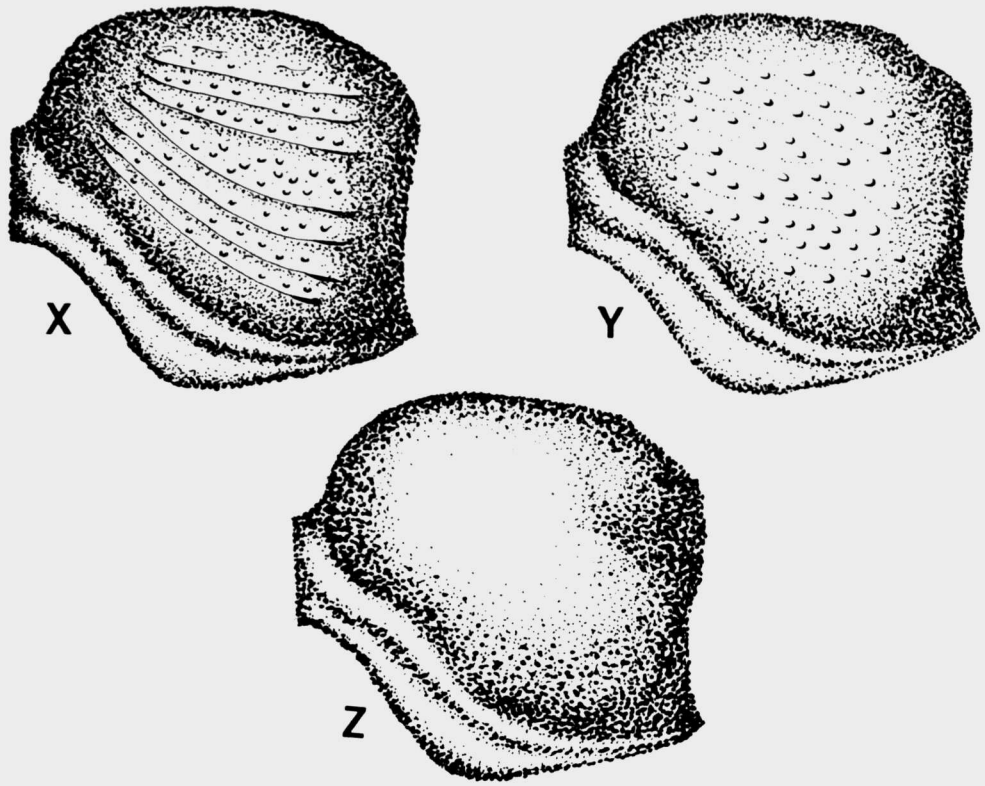

Fig. 1 Lateral views of left prothoracic pleurae in *Crematogaster* species, pilosity omitted. Sculptured cuticles, X and Y, characterize *C. cerasi, C lineolata,* and *C. vermiculata*. Smooth, reflective cuticle, Z, characterizes *C. ashmeadi, C. atkinsoni,* and *C. pilosa.*

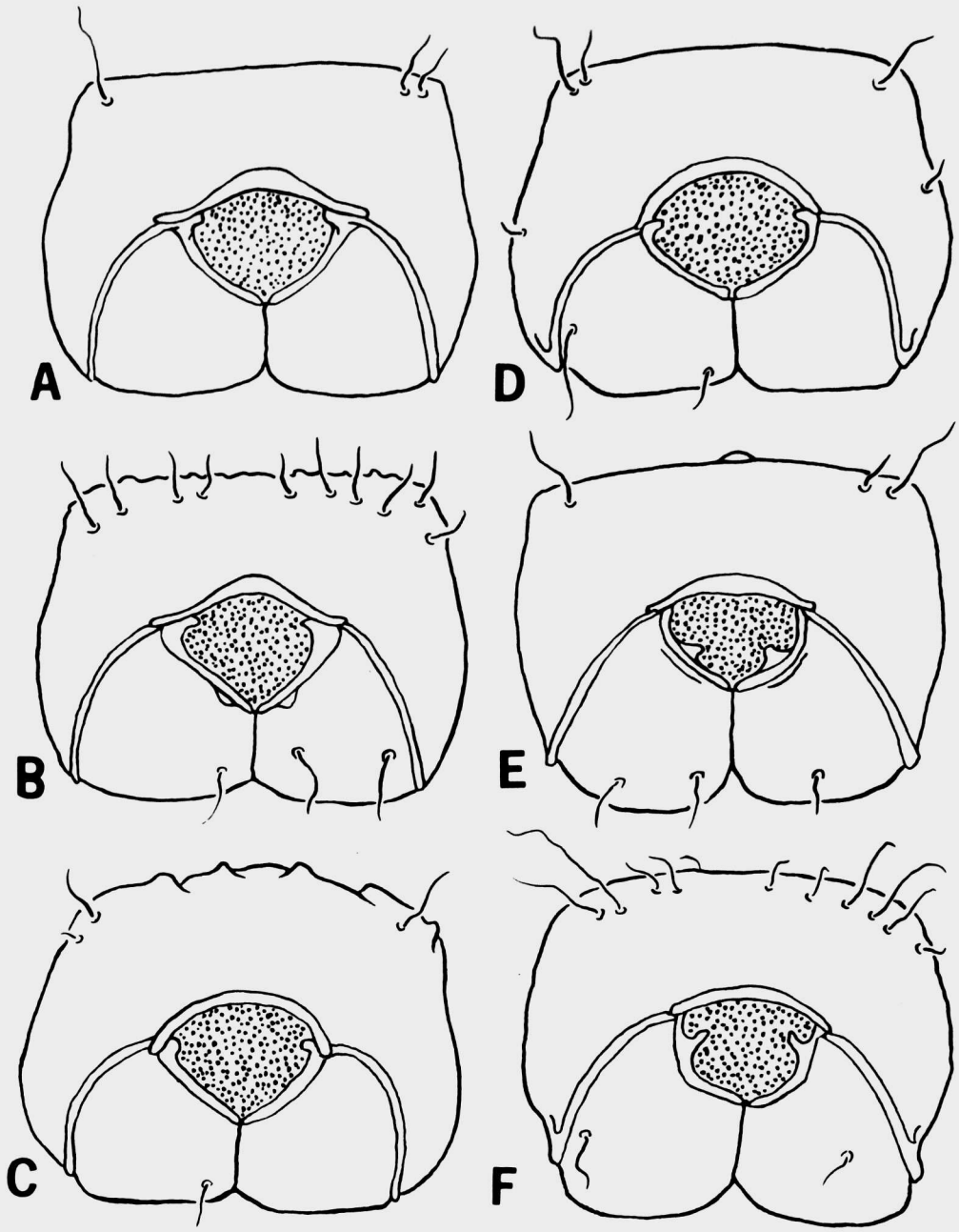

Fig. 2. Prothoracic profiles, in anterior view with head removed, showing pilosity patterns of *Crematogaster* species: A, *C. cerasi*; B, *C. lineolata*; C, *C. vermiculata*; D, *C. ashmeadi*; E, *C. atkinsoni* and F, *C. pilosa*.

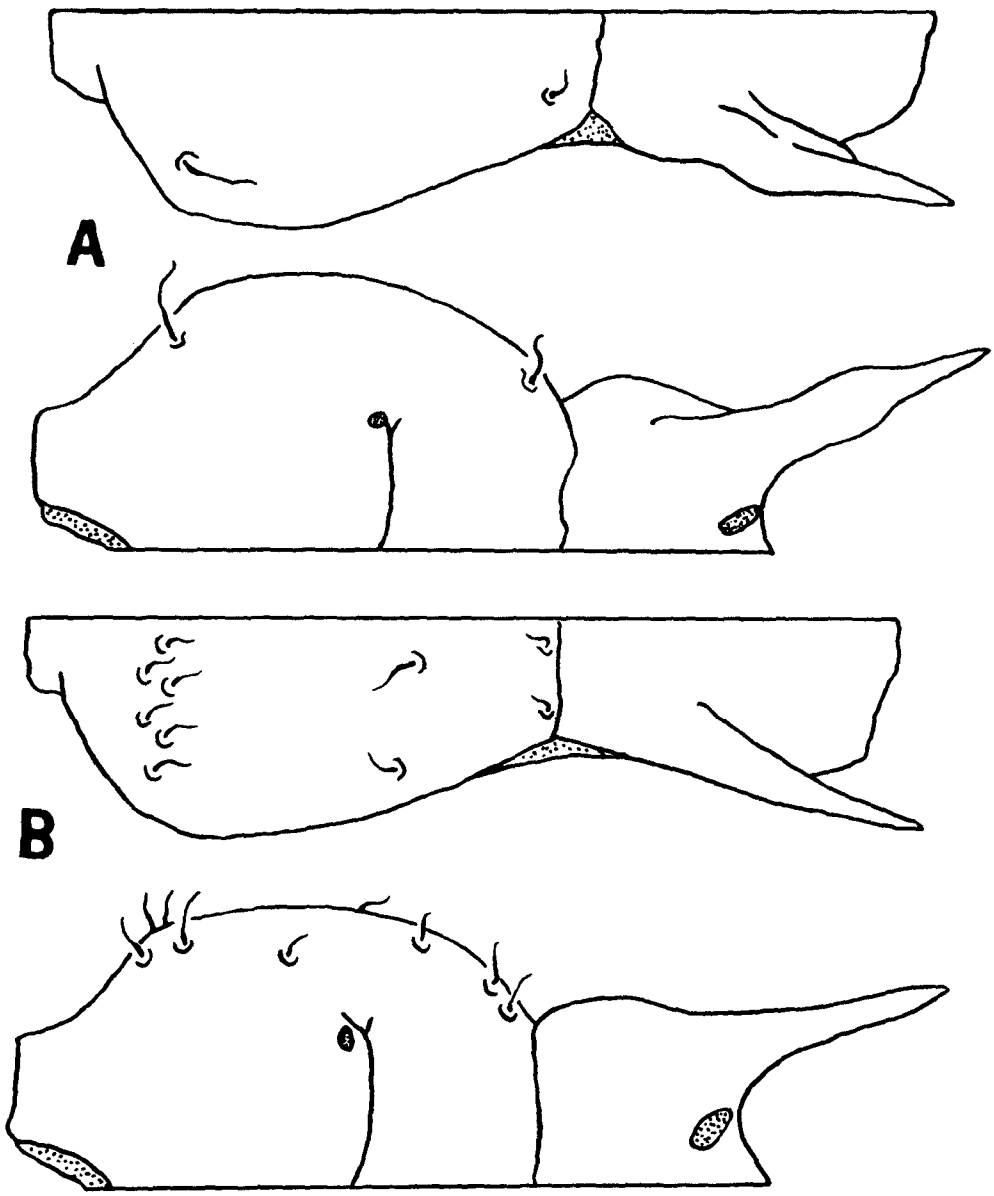

Fig. 3. *Crematogaster* alitrunk profiles for A, *C. cerasi* and B, *C. lineolata*. For both species, top and bottom drawings depict left dorsal and upper half of left lateral views respectively.

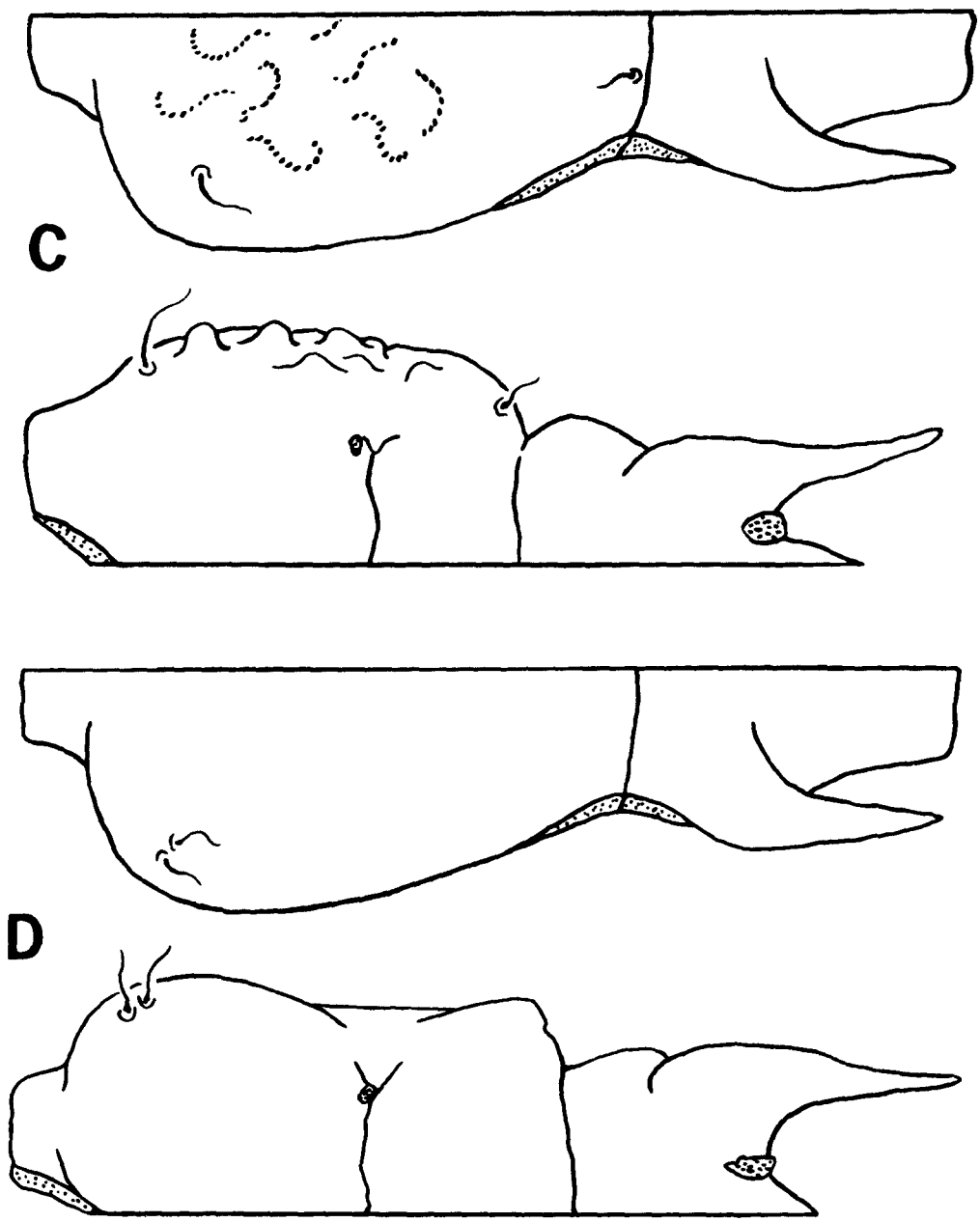

Fig. 4 *Crematogaster* alitrunk profiles for C, *C. vermiculata* and D, *C. ashmeadi*. Drawings arranged as in Fig. 3.

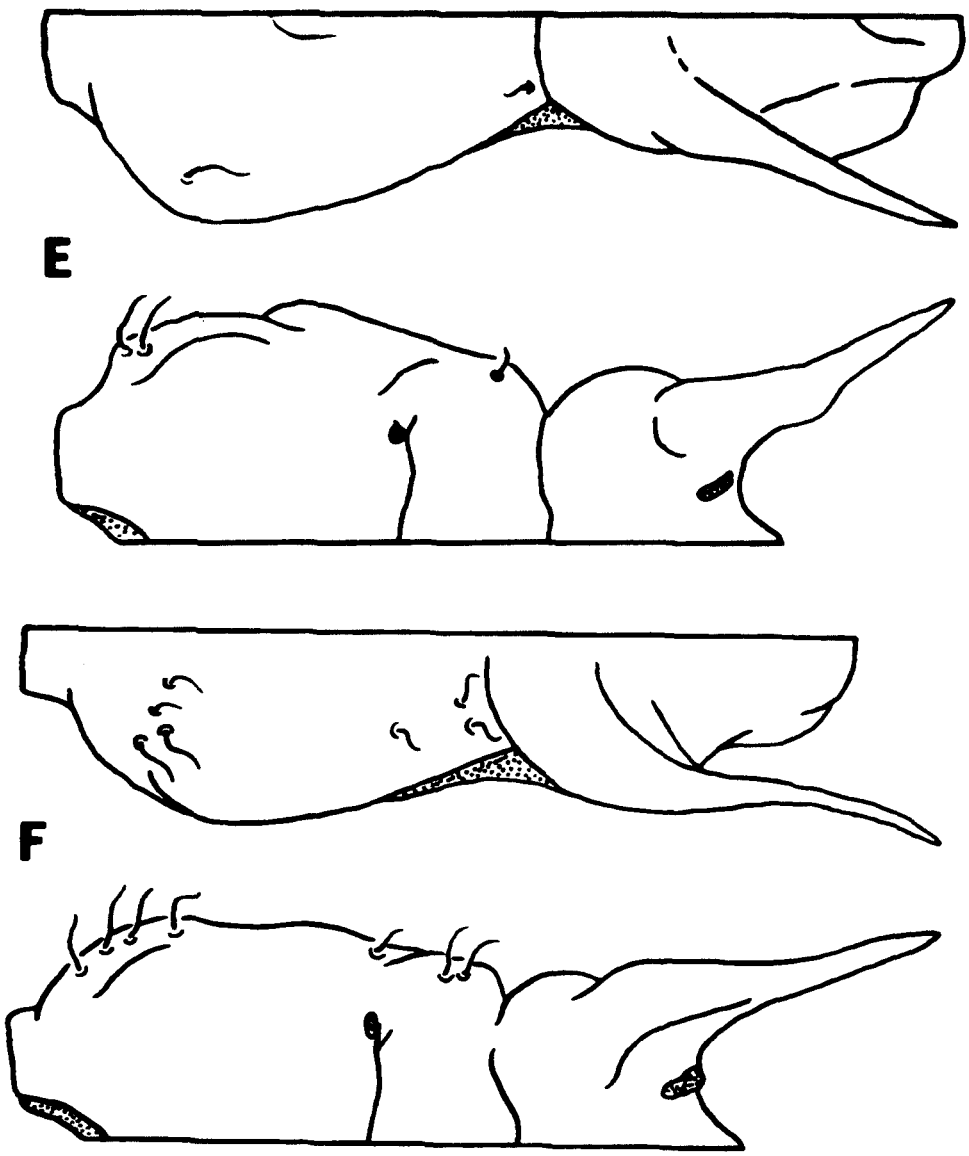

Fig. 5. *Crematogaster* alitrunk profiles for E, *C. atkinsoni* and F, *C. pilosa*. Drawings arranged as in Fig. 3.

Fig. 6. The head in left lateral oblique view for E, *C. atkinsoni* and F, *C. pilosa*, showing pubescence patterns.

Key to Workers

The user should initially examine the above character descriptions. The dichotomies for each key number utilize only one character; therefore, identified specimens should be confirmed by comparing other attributes described above. The following comments on sculpture enhance the interpretation of the key's first dichotomy. *Crematogaster cerasi, C. lineolata* and *C. vermiculata* have sculpture on the lateral sides, pleura, of the pronotum. The surfaces appear punctate with pits arranged in several diagonal rows or fine ridges, or the punctation may occur randomly. In all specimens, light reflection from the roughened cuticle is disrupted, the surface appears dull or opaque with smooth reflective surfaces reduced to small isolated areas, Fig. 1 X, Y. *Crematogaster ashmeadi, C. atkinsoni* and *C. pilosa* have a large area of smooth, unsculptured cuticle on the undulating surface of the upper half of both pleura of the pronotum, reflecting light well with a shining attribute, Fig. 1 Z. These three species also have a relatively smooth thoracic dorsum where the surface is shining or faintly granulose particularly on the mesonotum of some specimens.

1. Pleurae of pronotum sculptured giving a roughened, rather opaque surface, Fig. 1 X, Y 2
   Pleurae of pronotum largely unsculptured with a large smooth, reflective or shining surface, Fig. Z 4
2. A band of erect hairs occurs transversely across the pronotum, Fig. 2 B, and other erect hairs scattered randomly on mesonotum ..... *lineolata*
   Erect hairs of pronotum confined to humeral shoulders, Fig. 2 A, 2 C; occasional erect hairs may exist about anterior margin of propodeum 3
3. Thoracic dorsum rugose with a reticulate pattern of anastomosing ridges ..... *vermiculata*
   Thoracic dorsum with longitudinal, short striations or ridges, intervening cuticle granulate or punctate..... *cerasi*
4. Propodeal spines short and, in dorsal view, inner margins are parallel to longitudinal body axis, Fig. 4 D ..... *ashmeadi*
   Propodeal spines long and apices, in dorsal view, diverge from longitudinal body axis..... 5
5. Pubescence on head and thorax appressed, hairs on the head fine and oriented into orderly rows, Fig. 6 E..... *atkinsoni*
   Pubescence on head and thorax, in part, suberect to erect, and hairs on the head do not lie in orderly rows, Fig. 6F ..... *pilosa*

DISCUSSION

Type specimens for North American *Crematogaster* have been largely unavailable to workers in this country. Carlos Emery described *C. pilosa* and *C. vermiculata* and his collection is in the Museo Civico di Storia Naturale, Genoa, Italy. Gustav Mayr described *C. ashmeadi* and his collection is in the Naturhistorisches Museum, Vienna, Austria. W. M. Wheeler described *C. atkinsoni* and his collection is largely in the Museum of Comparative Zoology, Harvard. T.

Say and A. Fitch either did not designate types for *C. lineolata* and *C. cerasi* or they are now lost. The International Code of Zoological Nomenclature requires neotypes to be designated in a revision and the present paper does not meet that criterion. The next revision should, however, designate neotypes for those species. The Code also states that a neotype may be designated when justified by "exceptional circumstances". The present type of *C. vermiculata* has no accurate locality, date or collector and appears sufficiently exceptional to justify a neotype.

The lack of explanation by Buren (1958, 1968) for his nomenclatuural usage hampers reconstruction of earlier work; however, his use of *clara* for southern colonies of *C. pilosa* surely arose, in part, from unrecognized variation in that species. The taxonomic recognition of variants in *C. lineolata* was also the result, in part, of not questioning their biology in the field. Namely, intraspecific variability received little attention. Hopefully, workers will acknowledge variability within a species and view it as a clue to interesting physiological and ecological adaptations.

A number of neotropical *Crematogaster* species occur in the West Indies but have never moved northward to colonize the U. S. coastline to our knowledge. Likewise, only *C. ashmeadi* from the north temperate fauna has been reported south of the eastern U. S. mainland in the Bahamas. The southern U. S. coastline has, however, been colonized by a number of exotic ants including arboreals such as *Pseudomyrmex*. These observations suggest that *Crematogaster* species are rather poor colonizers.

SUMMARY

Six species of *Crematogaster*, subgenus *Crematogaster*, occur in the U. S. east of the Mississippi River, *C. ashmeadi* Mayr, *C. atkinsoni* Wheeler, *C. cerasi* (Fitch), *C lineolata* (Say), *C. pilosa* Emery and *C. vermiculata* Emery. Validity of the taxonomic nomenclature for each species is developed and the erroneous use of *C. clara* for eastern populations of *C. pilosa* is explained. The intraspecific variability of *C. lineolata* is shown to include the morph *punctulata*. The latter taxon is not a distinct species in the East and its validity in the West requires field studies in that region.

Descriptions of diagnostic attributes in workers, geographical distribution in the East and preferred habitat appear for each species. Finally, a key supported by figures is presented for workers of the six species.

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